UNITED STATES ARMY AVIATION AND MISSILE COMMAND
Lifecycle Management Command

U.S. Army Aviation & Missile Command Hexavalent Chromium Coatings Replacement Program

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Report Documentation Page

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Test Program Background

- AMCOM Testing effort focused on the performance of the coating system
  - Technical approach was more holistic
    - Focus was on coating system performance vice individual system component capabilities
- Test Program leveraged off of other DoD and commercial test efforts
  - NAVAIR – ESTCP Non-Chrome Aluminum Pretreatments
  - Air Force - PreKote
  - Air Force/NAVAIR Non-Chrome Epoxy Primer
  - Deft/Hentzen Class N Primer development

Test Program Background

- **Testing performed Fall/Winter/Spring 2003-2004 at NAVAIR Patuxent River and ARL Aberdeen**
  - **NAVAIR performed pretreatment and coating application**
  - **ARL performed corrosion, EIS and adhesion testing on the coated samples**
    - **ASTM Adhesion testing performed on both wet and dry samples**
    - **Corrosion testing evaluated samples in neutral salt fog (B117) and Cyclic (GM9540)**

Test Program Background

- **Substrate Materials evaluated included:**
  - **2024 and 7075 Aluminum (T6 tempers) various test pretreatments**
  - **4340 High Strength Steel (Cd plated)**
  - **ZE41A Magnesium (Dow 17 and PreKote Treated)**
  - **G11 Composite (no pretreatment)**
- **Coating Products Evaluated**
  - **Class N Primer (MIL-PRF-85582 Type I)**
  - **MIL-DTL-53039 and 64159 CARCs**
  - **Alternate conversion coatings: Alodine 5700, Alodine T5900RTU and PreKote**

Test Program Background

- **Test results indicated the following materials were the best non-hexavalent chromium products**
  - **MIL-DTL-81706 Type II (TCP)**
    - **4 Manufacturers have qualified products**
      - **Products available as concentrates or ready-to-use**
      - **NSNs requested and Army transition will follow**
  - **MIL-PRF-23377 Class N**
    - **2 Manufacturers have qualified products**
      - **NSNs obtained and Army transition in-progress**

ON-AIRCRAFT TESTING

- Initial Test coating applied to CH-47 by 1109th Aviation Classification Repair Activity Depot (AVCRAD) Groton Fall 2005
  - Pretreatment MIL-DTL-81706 Type II (TCP)
  - Upper fuselage received a Class C primer, lower fuselage the Class N primer
  - MIL-DTL-64159 Type II CARC
- Additional coating applications continued at the 1109th AVCRAD throughout 2006 and 2007
  - New coating system used on CH-47, UH-60 and AH-64 rotary-wing aircraft

Non-hexavalent Chromium Primers

- **Several Class N Primers are now available for use**
- **MIL-PRF-23377 Type I and II Class N NSNs**
  - **Type I – 8010-01-555-3381 (1 Gal Kit)**
    - **Mfr P/N 16708TEP/16709CEH Hentzen**
    - **Mfr P/N 02GN084 (Deft)**
  - **Type I – 8010-01-555-3386 (1 Quart Kit)**
    - **Same P/N**
  - **Type II – 8010-01-555-3383 (1 Gal Kit)**
    - **Mfr P/N – 17176KEP/16709CEH (Hentzen)**

Non-hexavalent Chromium Primers

- **MIL-PRF-85582 Type I and II Class N NSNs**
  - **Type I – 8010-01-555-3385 (1 Gal Kit)**
    - **Mfr P/N - 44GN098 (Deft)**
  - **Type I – 8010-01-555-3388 (1 Quart Kit)**
    - **Mfr P/N - 44GN098 (Deft)**
  - **Existing NSNs for MIL-PRF-85582 Type I and II Class N**
    - **8010-01-466-9037 (Type I 2-Gal/Kit)**
    - **8010-01-466-9313 (Type II 2-Gal/Kit)**

Non-hexavalent Chromium Primers Issues

- **AMCOM Authorization for the use of Class N Primers in-progress**
  - **Maintenance Information Message (MIM) will be distributed when NSNs have been added to the Authorized Users List (AUL) for Aviation Systems and Equipment (in-progress)**
    - **Per discussion with the Integrated Material Management Center (IMMC), the MIM is still at Aviation Safety awaiting final approval before distribution**
  - **Follow-on MIMs will be issued for MIL-DTL-81706 Type II products when NSNs have been assigned**

MIL-DTL-81706

- **Request has been submitted to the GSA for NSN Assignment for MIL-DTL-81706 Type II Class 1a and 3 products (Trivalent Chromium Process – TCP)**
  - **Type II products do not use hexavalent chromium ($Cr+^{6}$)**
  - **Primer adhesion in many applications is improved over Type I conversion coatings**
  - **Corrosion inhibition performance not impacted by elevated temperatures**
    - **No breakdown when used under powder coatings cured at temperatures that would damage Type I conversion coatings**

MIL-DTL-81706

- **May be other potential applications for the TCP materials**
  - **Testing is in-process to evaluate TCP as a seal coating over:**
    - **Acid and alkaline zinc-nickel plate**
    - **Zinc plate**
    - **Phosphate treatments over steel**
    - **Final rinse/seal over hard anodized aluminum**

NEW CARC MIL-DTL-53039

- **New CARC coatings conforming to MIL-DTL-53039 Type II will be available in the near future**
  - **Type II products contain <1.5 lb/gal VOCs and 0 Volatile Hazardous Air Pollutants**
  - **CARCs use either silica or polymeric bead flattening**
  - **New NSNs to be assigned to differentiate from older MIL-C- or MIL-DTL-53039 coatings**

NEW CARC COATINGS

- New ‘53039 Type II Beaded CARC will initially be available in the most common Aviation colors:
  - Aircraft Green (Color No. 34031),
  - Aircraft Black (Color No. 37038),
  - Aircraft Interior Black (Color No. 37031) and
  - Aircraft Interior Grey (Color No. 36231)
  - Still awaiting final qualification of the new Desert Sage color (Color No. 34201) for the CH-47
  - Insignia Blue (35044), Aircraft Red (31136), Aircraft White (37875) will be available as a Type I coating for the immediate future (silica flatteners)

NEW COATING TRANSITION

- When changing to the new primer and CARC coatings initial results were mixed
  - AVCRAD personnel closely followed mix/application guidelines with OEM techreps present
    - No noted difficulties and good results
  - Other facility painters did not review technical guidelines and proceeded to apply the new primer like the previous products
    - Inadequate mixing resulted in some of the coating failures
    - Wet/dry film thickness was not properly controlled
    - Improper paint gun settings and tip orifice sizes resulted in poor control of the applied coating
    - Top-coating was applied before primer had sufficient time to fully cure

PAINTING INFRASTRUCTURE

- G-4/Coating OEM performed an on-site assessment of the painting operations at a primary AMCOM facility
- Personnel provided recommendations to improve painting operations, maximize productivity, minimize waste:
- Infrastructure review focused on several contributing areas:
  - Storage areas need to be less exposed to wide temperature swings
  - Mixing Equipment
    - Single or Dual Arm aggressive paint “shakers” are needed to properly mix the new high solids primer and CARC coatings
    - Proper process needs to be followed to mix the two-component coatings

PAINTING INFRASTRUCTURE

- **Infrastructure review (continued):**
  - **Application Equipment**
    - **High Volume/Low Pressure (HVLP) guns**
      - **All of the paint guns in each paint shop should be standardized (standardized in entire facility would be best)**
        - » **Proper repair parts must be available in each shop**
      - **Proper tip orifice critical with the new coatings**
    - **Paint pots that use vertical or paddle agitators to keep suspended solids evenly distributed are required**
      - **Proper operation of in-pot agitators is important**
      - **Paint pots must be kept on optimum condition**

PAINTING INFRASTRUCTURE

- **Infrastructure Review (continued)**
  - **Supply air**
    - Supply air systems must provide sufficient pressure and volume
    - Inline air dryers to ensure air supplied to pressure pot/gun is moisture- and oil-free
    - Easily accessible and operable traps and blow downs to keep air lines contaminant free
    - Regular inspections and maintenance on the systems to maintain top performance
    - Airlines should be properly sized and configured for optimum performance
      - Separate supply lines for pot pressurization and atomization air

PAINTING INFRASTRUCTURE

- **Infrastructure Review (continued)**
  - **Paint Booth Climate Controls**
    - **Need to keep the booth at a nominal 50% relative humidity**
    - **Control temperatures in the booth at:**
      - **70ºF or above (winter months),**
      - **90ºF or below (summer months)**
    - **Aircraft should be acclimated to the booth temperature prior to coating application**

PAINTING PROCESSES

- **New Primers and CARCs are not the same coatings as previously used**
  - **Transition to the new coatings will require painter familiarization with the coating prior to spraying an aircraft**
    - **Hands-on training and test panel spraying recommended prior to 1st application on an aircraft**
    - **Training should emphasize:**
      - **Understanding ambient condition impacts on coating application and drying**
        - » **Temperature and humidity**
      - **Proper mixing**
      - **Sufficient drying time between coating applications**
      - **Controlling wet-film thickness and edge blending**

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